



Referred to Goddard
(CATMS)

**CORTEZ III SERVICE CORPORATION
NASA/GODDARD SPACE FLIGHT CENTER
CODE 239, BLDG 27
GREENBELT, MD 20771
FAX (301) 286-1774**

02 MAR 01
Stan
Schneider

DATE: Feb. 22, 2001 **#PAGES** (including cover sheet)

TO: STANLEY R. SCHNEIDER
AT: _____
PHONE (VOICE/FAX) _____

FROM: ODELL YOUNG, IMPORT/EXPORT SPECIALIST
PHONE: (301) 286-6388
EMAIL: oyoung@pop200.gsfc.nasa.gov

IF YOU DO NOT RECEIVE ALL TRANSMITTED SHEETS, PLEASE CALL
(301) 286-6388

Comments:

DEPT OF STATE, CASE #DSP-5 813422

STAN,
PLEASE REVIEW THE ATTACHED CASE AND ADVISE IF IT IS
IN ACCORDANCE WITH YOUR PROGRAM REQUIREMENTS.
YOUR REPLY VIA EMAIL WITHIN THE NEXT SEVEN DAYS
WILL BE GREATLY APPRECIATED.

ODELL



DTC CASE REFERRAL DOCUMENT

ADMIN USE FEB -5 2001		DATE STAFFED		DTC CASE NUMBER 813422									
DSP-5		<input checked="" type="checkbox"/>	DSP-61			DSP-73			DSP-119			DSP-85	
DTC CASE OFFICER: <i>George R. Moose</i> (202) 663-2714													
Cost Proposal from potential vendors for NASA Contract-U.K.													
X 5	DTRA/LD		NEA/RA		DRL/MLA	<input checked="" type="checkbox"/>	Transmittal Letter						
							Attachments, stated on appl						
X 2	NASA		EAP/RSP		OES	<input checked="" type="checkbox"/>	Tech data/Descrip Literature						
							Statement of Work						
	ENERGY		EUR/RPM		PM/RSAT	<input checked="" type="checkbox"/>	Order/Ltr of Intent/Contract						
							Copy of Contract						
	DOT/USCG		AF/RA		NP/CBM		Copy of previous approvals						
							End Use Certificate/DSP-83						
	COMMERCE		WHA		DTC/CEB	<input checked="" type="checkbox"/>	Import Authorization						
							Other (videocassette, etc.)						
	L/PM		SA/RA		DTC/RAB		Nothing						
						7	# of Collated Sets						
	PKRC												

REPLY HERE AND RETURN TO DEPARTMENT OF STATE, OFFICE OF DEFENSE TRADE CONTROLS, WASHINGTON, D.C. 20520-0206. Recommendations within 25 working days of date staffed are appreciated. **PROVIDE COMMENTS FOR ANY RECOMMENDATION TO DENY OR RETURN WITHOUT ACTION (RWA).**

RECOMMENDATION & COMMENTS:

<input type="checkbox"/>	APPROVE	<input type="checkbox"/>	APPROVE <u>WITH</u> PROVISIO	<input type="checkbox"/>	RWA	<input type="checkbox"/>	DENY
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COMMENTS:

Typed/Printed NAME AND OFFICE SYMBOL

SIGNATURE

DATE: _____

Telephone Number: _____

Signature

License is hereby granted to the applicant for the described commodity to be permanently exported from the United States. This license may be revoked, suspended or amended by the Secretary of State without prior notice whenever the Secretary deems such action advisable.

8 13422

LICENSE NO.

LICENSE VALID FOR
MONTHS FROM ABOVE DATE

UNITED STATES OF AMERICA DEPARTMENT OF STATE

APPLICATION/LICENSE FOR PERMANENT EXPORT OF UNCLASSIFIED
DEFENSE ARTICLES AND RELATED UNCLASSIFIED TECHNICAL DATA

Date Prepared 15 January 2001	2. PM/DTC Applicant/Registrant Code 1204-1719	3. Country of Ultimate Destination United Kingdom	4. Probable Port of Exit from U.S. Los Angeles, CA New York, NY
5. Applicant's Name, Address, ZIP Code, Tel. No. Applicant is: <input type="checkbox"/> Government <input checked="" type="checkbox"/> Manufacturer <input type="checkbox"/> Exporter/freight forwarder GenCorp Inc. Aerojet General Corp. 1100 W. Hollyvale Street Azusa, CA 91702 TELEPHONE NUMBER: 626-812-1439		6. Names, agency and telephone numbers of U.S. Government personnel (not PM/DTC) familiar with the commodity <input type="checkbox"/> Army <input type="checkbox"/> Air Force C. Whyte/PCO 301-286-3230 <input type="checkbox"/> Navy <input checked="" type="checkbox"/> Other NASA S. Krimchansky/COTR 301-286-9843	
		7. Name and telephone number of applicant contact if U.S. Government needs additional information. Carol Brenson 626-812-1439	

8. Description of Transaction

a. This application represents: ☒ ONLY completely new shipment; ☐ ONLY the unshipped balance of license no. _____

b. The IDENTICAL commodity ☐ was licensed to the country in block 3 under license no. _____; ☐ was licensed to other countries under license no. _____; ☐ was returned without action under voided license no. _____; ☐ was denied to the country in block 3 under voided license no. _____; ☒ was never licensed for this applicant.

c. If commodity is being financed under ☐ Foreign Military Sale (FMS); ☐ Foreign Military Financing (FMF) or; ☐ Grant Aid Program (GAD), give the case number: **N/A**

9. QUANTITY LOT	10. COMMODITY <input type="checkbox"/> Hardware <input checked="" type="checkbox"/> Technical Data PRODUCT DESCRIPTIONS, DESIGN TO SPECIFICATION DATA (STATEMENT OF WORK, DRAWINGS AND SPECIFICATIONS) FOR THE FOLLOWING COMPONENTS: KAV POLARIZING GRID (P/N 1362336) WG POLARIZING GRID (P/N 1362337) G DIPLEXER (P/N 1363053) G FEEDHORN (P/N 1362122)	11. USML CAT. XV(f) for XV(e)	12. VALUE -0- (No Commercial Value)
		13. TOTAL VALUE: \$ -0-	

14. Name and address of foreign end-user Thomas Keating Ltd. Station Mills, Billingshurst West Sussex RH14 9SH United Kingdom	15. <input checked="" type="checkbox"/> Source or <input type="checkbox"/> Manufacturer of Commodity Aerojet 1100 W. Hollyvale Street Azusa, CA 91702
---	---

16. Name and address of foreign consignee Same as Block 14	17. Name and address of seller in United States Aerojet 1100 W. Hollyvale Street Azusa, CA 91702 (NO FOREIGN "SALE" UNDER THIS LICENSE.)
--	--

18. Name and address of foreign intermediate consignee Archibald Hamilton Rhyll Manor Maddicombe, Dulverton Somerset TA22 9RX United Kingdom	19. Name and address of consignor and/or freight forwarder in United States U.S. Postal Service, DHL, 333 Twin Dolphin Dr., Redwood City, CA (Corp) Telephone, Facsimile, Meetings in U.S. or U.K.
--	--

20. Specific purpose for which the material is required, including specific program/end item Obtain product feasibility and cost proposals from potential vendor; offshore procurement activity in accordance with 22 CFR 124.13 for NASA contract.	21. APPLICANT'S STATEMENT (See Instructions) I, CAROL BRENSON (Typed name), hereby apply for a license to complete the transaction described above; warrant the truth of all statements made here and acknowledge, understand and will comply with the provisions of Title 22 C 120 - 130, and any conditions and limitations imposed. CHECK ALL THAT APPLY: <input checked="" type="checkbox"/> I am a responsible official empowered by the applicant to certify that the conditions 22 CFR 126.13 and 22 CFR 130 as listed on the reverse of this form have been met in full. <input type="checkbox"/> The applicant, or another party to this export cannot meet one or more of the conditions 22 CFR 126.13 and 22 CFR 130. A request for an exception to policy is attached.
22. LICENSE TO BE SENT TO: Name, address, ZIP code Aerojet	



APPLICATION/LICENSE FOR PERMANENT EXPORT OF UNCLASSIFIED DEFENSE ARTICLES AND RELATED UNCLASSIFIED TECHNICAL DATA

1. Date Prepared 15 January 2001		2. PM/DTC Applicant/Registrant Code 1204-1719		3. Country of Ultimate Destination United Kingdom		4. Probable Port of Exit from U.S. Los Angeles, CA New York, NY	
5. Applicant's Name, Address, ZIP Code, Tel. No. Applicant is: <input type="checkbox"/> Government <input checked="" type="checkbox"/> Manufacturer <input type="checkbox"/> Exporter/freight forwarder GenCorp Inc. Aerojet General Corp. 1100 W. Hollyvale Street Azusa, CA 91702 TELEPHONE NUMBER: 626-812-1439				6. Names, agency and telephone numbers of U.S. Government personnel (not PM/DTC) familiar with the commodity <input type="checkbox"/> Army <input type="checkbox"/> Air Force <input type="checkbox"/> Navy <input checked="" type="checkbox"/> Other C. Whyte/PCO 301-286-3230 S. Krimchansky/COTR 301-286-9843			
7. Name and telephone number of applicant contact if U.S. Government needs additional information. Carol Brenson 626-812-1439							
8. Description of Transaction a. This application represents: <input checked="" type="checkbox"/> ONLY completely new shipment; <input type="checkbox"/> ONLY the unshipped balance of license no. _____ b. The IDENTICAL commodity <input type="checkbox"/> was licensed to the country in block 3 under license no. _____; <input type="checkbox"/> was licensed to other countries under license no. _____; <input type="checkbox"/> was returned without action under voided license no. _____; <input type="checkbox"/> was denied to the country in block 3 under voided license no. _____; <input checked="" type="checkbox"/> was never licensed for this applicant. c. If commodity is being financed under <input type="checkbox"/> Foreign Military Sale (FMS); <input type="checkbox"/> Foreign Military Financing (FMF) or; <input type="checkbox"/> Grant Aid Program (GAD), give the case number: N/A							
9. QUANTITY LOT		10. COMMODITY <input type="checkbox"/> Hardware <input checked="" type="checkbox"/> Technical Data PRODUCT DESCRIPTIONS, DESIGN TO SPECIFICATION DATA (STATEMENT OF WORK, DRAWINGS AND SPECIFICATIONS) FOR THE FOLLOWING COMPONENTS: KAV POLARIZING GRID (P/N 1362336) WG POLARIZING GRID (P/N 1362337) G DIPLEXER (P/N 1363053) G FEEDHORN (P/N 1362122)		11. USML CAT. XV(f) for XV(e)		12. VALUE -0- (No Commercial Value)	
				13. TOTAL VALUE: \$ -0-			
14. Name and address of foreign end-user Thomas Keating Ltd. Station Mills, Billingshurst West Sussex RH14 9SH United Kingdom				15. <input checked="" type="checkbox"/> Source or <input type="checkbox"/> Manufacturer of Commodity Aerojet 1100 W. Hollyvale Street Azusa, CA 91702			
16. Name and address of foreign consignee Same as Block 14				17. Name and address of seller in United States Aerojet 1100 W. Hollyvale Street Azusa, CA 91702 (NO FOREIGN "SALE" UNDER THIS LICENSE.)			
18. Name and address of foreign intermediate consignee Archibald Hamilton Rhyll Manor Waddicombe, Dulverton Somerset TA22 9RX United Kingdom				19. Name and address of consignor and/or freight forwarder in United States U.S. Postal Service, DHL, 333 Twin Dolphin Dr., Redwood City, CA (Corp) Telephone, Facsimile, Meetings in U.S. or U.K.			
20. Specific purpose for which the material is required, including specific program/end item Obtain product feasibility and cost proposals from potential vendor; offshore procurement activity in accordance with 22 CFR 124.13 for NASA contract.				21. APPLICANT'S STATEMENT (See Instructions) I, <u>CAROL BRENSON</u> (Typed name), hereby apply for a license to complete the transaction described above; warrant the truth of all statements made herein; and acknowledge, understand and will comply with the provisions of Title 22 CFR 120 - 130, and any conditions and limitations imposed. CHECK ALL THAT APPLY: <input checked="" type="checkbox"/> I am a responsible official empowered by the applicant to certify that the conditions of 22 CFR 126.13 and 22 CFR 130 as listed on the reverse of this form have been met in full. <input type="checkbox"/> The applicant, or another party to this export cannot meet one or more of the conditions in 22 CFR 126.13. A request for an exception to policy is attached. <input type="checkbox"/> U.S. consignor(s) and/or freight forwarder list(s) is/are attached. <input type="checkbox"/> I am not empowered by the applicant to certify that the conditions of 22 CFR 126.13 and 22 CFR 130 as listed on the reverse of this form have been met in full. Please see the attached letter for such certification. Signature <u><i>Carol Brenson</i></u>			
22. LICENSE TO BE SENT TO: Name, address, ZIP code Aerojet Attn: Carol Brenson, 59-1/1321 P.O. Box 296 Azusa, CA 91702							

FORM 10-93 DSP-5

1 APPLICATION/LICENSE

OMB APPROVAL NO. 1405-0003
EXPIRATION DATE: 12-31-95
ESTIMATED BURDEN: 1/2 HOUR

APPROVED LICENSE MUST BE PRESENTED TO U.S. CUSTOMS OR POST OFFICE PRIOR TO EXPORT/MAILING

*Public reporting burden for this collection of information is estimated to average 1/2 hour per response, including time required for searching existing data sources, gathering the necessary data, providing the information required, and reviewing the final collection. Send comments on the accuracy of this estimate of the burden and recommendations for reducing it to: Department of State (OIS/RA/DR) Washington, D.C. 20520-0254, and to the Office of Information and Regulatory Affairs, Office of Management and Budget, Paperwork Reduction Project (1405-0003), Washington, D.C. 20503.



P O Box 296
1100 West Hollyvale Street
Azusa CA 91702

Tel: 626-812-1439
Fax: 626-969-9010
Carol.Brenson@Aerojet.com

15 January 2001
1321:01:00823

Mr. William J. Lowell, Director
Office of Defense Trade Controls
PM/DTC SA-1, Room 1304
U.S. Department of State
Washington, D.C. 20520

Subject: DSP-5 License Application for Technical Data
to Thomas Keating Ltd. of the United Kingdom

Applicant Code: 1204-1719

Munitions List Category: Category XV(f)/Technical Data related to XV(e)/Component

Reference: NASA-Goddard Space Flight Center Contract NAS5-01089
Advanced Technology Microwave Sounder (ATMS)

Dear Mr. Lowell:

Enclosed is an application for the export of unclassified technical data to Thomas Keating Ltd in Billingshurst West Sussex, England, United Kingdom. Data (statements of work, drawings, specifications, requirements information) sufficient to allow Thomas Keating Ltd. to provide cost estimates for their design and fabrication (offshore procurement) of millimeterwave (MMW) antenna components would be exported. These components (polarizing grids, diplexer and feedhorn) are to be used in a remote sensing meteorological satellite instrument for NASA. Eight sets of the license application, this cover letter, and preliminary product specifications and statements of work for the diplexer and feedhorn, indicating the type of information that will be provided to the U.K. company, along with build to print drawings for the large and small polarizing grids.

Thomas Keating Ltd. an industry leader in the design and fabrication of MMW radiometer antenna components, has the capability to design and manufacture the items to our specifications without any assistance from Aerojet. However, Aerojet expects to submit a Technical Assistance Agreement in the future, to facilitate activities (i.e., preliminary design reviews for the diplexer and feedhorn) with this potential vendor that may exceed the initial export authorization of this DSP-5.

The components expected to be procured from Thomas Keating Ltd. will be incorporated into deliverable hardware for NASA. Under the referenced contract, Aerojet will build the Advanced Technology Microwave Sounder (ATMS), a next generation, satellite microwave instrument for use and climate change research. The instrument will measure microwave

A GenCorp Company

1 COVER LETTER

Aerojet to ODTC
1321:01:00823

energy emitted and scattered by the atmosphere. When combined with observations from an infrared sounder, ATMS will provide daily global atmospheric temperature, moisture, and Aerojet to ODTC pressure profiles. The first ATMS will fly on the National Polar-Orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project mission, a joint effort between NASA and the NPOESS program office. NPOESS is a tri-agency program, including NASA, NOAA and the U.S. Air Force.

If additional information is required, please contact the undersigned at (626) 812-1439, telefax (626) 969-9010, or Chuck Abernethy, our Washington D.C. representative at (202) 828-6816.

A pre-addressed Federal Express airbill is enclosed to facilitate ODTC's response to this application.

Yours truly,

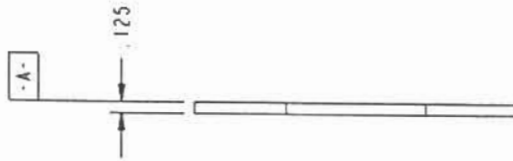
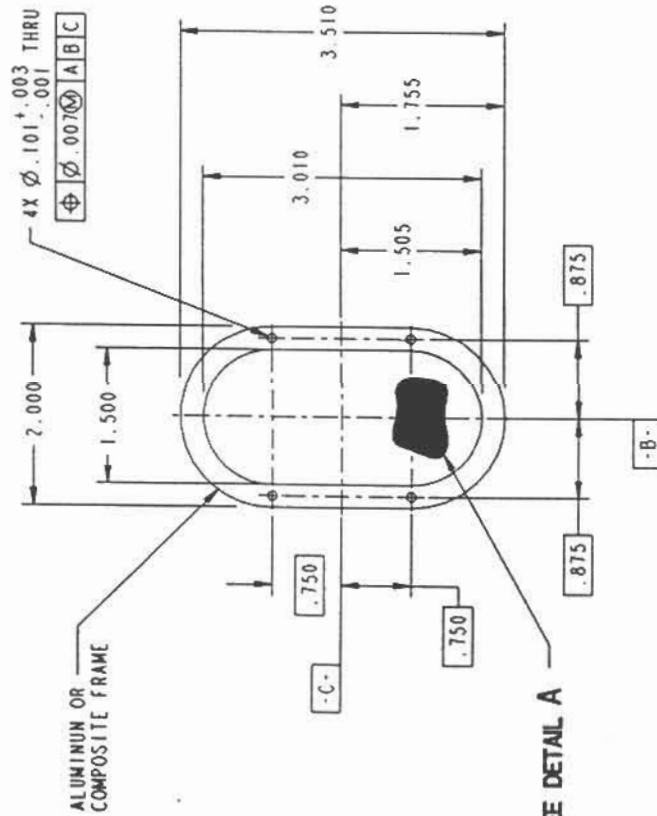


Carol Brenson
Export Control Manager

Enclosures: 9 sets	Application
	Cover Letter
	Drawing 1362336 for Polarizing Grid, Large
	Drawing 1362337 for Polarizing Grid, Small
	G Feedhorn Product Specification Flysheet (preliminary)
	G Feedhorn Statement of Work
	G Diplexer Product Specification Flysheet (preliminary)
	G Diplexer Statement of Work

cc: Mr. Christopher Whyte
NASA Goddard Space Flight Center

NOTES:



DETAIL A

GENCORP AEROJET		P.O. BOX 734 AZUSA, CA. 91702-0734
TITLE		POLARIZING GRID, SMALL
CAGE CODE		70143
SCALE		1/1
SHEET		1 OF 1
DATE		1362337
DRAWN		DATE
CHECKED		DATE
APPROVED		DATE
DESIGNED		DATE
MATERIALS		DATE
SURFACE FINISH		DATE
DIMENSIONS		DATE
DRAWING INTERPRETATION		DATE
PER		DATE
PART NAME		DATE
QTY REQD		DATE
BY		DATE
APP. ASSY		DATE
USED ON		DATE
APPROVAL		DATE

REVIEWS

SEE DETAIL A



022 TYP

[illegible]

Special 801 1/2004

G Diplexer

Product Specification Flysheet

Aerojet intends to replace this document with a full product specification, the sole purpose of this document is to demonstrate to the United States State Department the type of parameters which must be conveyed to a foreign entity in order to facilitate the design and development of the G Diplexer.

1. Product Functional Description

Under a NASA contract, Aerojet will build the Advanced Technology Microwave Sounder (ATMS), a next generation, satellite microwave instrument for use in weather forecasting and climate change research. The instrument will measure microwave energy emitted and scattered by the atmosphere. When combined with observations from an infrared sounder, ATMS will provide daily global atmospheric temperature, moisture, and Aerojet to ODTC pressure profiles. The first ATMS will fly on the National Polar-Orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project mission, a joint effort between NASA and the NPOESS program office. NPOESS is a tri-agency program, including NASA, NOAA and the U.S. Air Force.

The G Diplexer receives the output from a feedhorn, which collects the energy for channels 17-22 of the instrument, and separates channel 17 from the 18-22 channels. This device has 3 ports: Port 1 is the input port and receives the signal from the feedhorn, Port 2 is the through output port and allows the energy for channels 18-22 to pass through, and Port 3 is the side output port which passes the energy for channel 17.

2. Product Physical Description

The maximum envelope for the G Diplexer dimensions are shown in Figure 1. The maximum weight for this device shall be ≤ 0.07 Kg.

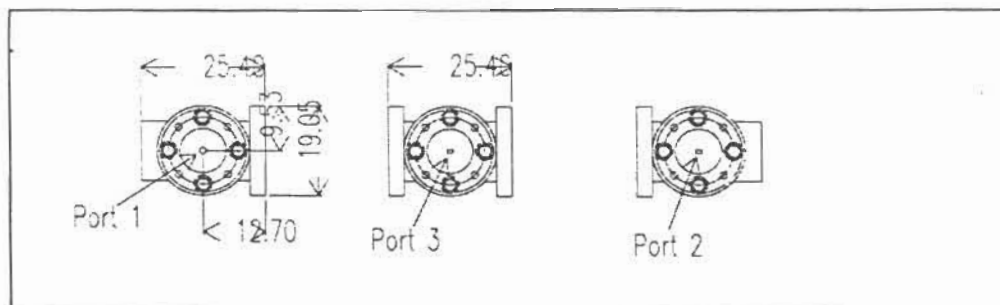


Figure 1 G Diplexer Envelope Specification

3. Frequency and Bandwidth Designations

For the purpose of the specifications contained within this flysheet, the frequency and bandwidths for the channels shall be as shown in Table 1.

Channel	Frequency (Ghz)	Bandwidth (Mhz)
17	166.30	3,000
18	183.31±7.0	2,000
19	183.31±4.5	2,000
20	183.31±3.0	1,000
21	183.31±1.8	1,000
22	183.31±1.0	500

Table I G Diplexer Frequency and Bandwidth designations.

4. VSWR

The input VSWR shall be as shown in Table 2.

Port	Channel	VSWR
1	17	≤ 1.5:1
	18-22	≤ 1.5:1
2	17	≤ 1.5:1
	18-22	≤ 1.5:1
3	17	≤ 1.5:1
	18-22	≤ 1.5:1

Table II G Diplexer VSWR Requirements

5. Transmission Insertion Loss

The transmission insertion loss of the G Diplexer shall be as shown in Figure III.

Port	Channel	Transmission Insertion Loss
1	17	≤ 1.5 dB
	18-22	≤ 1.5 dB
2	17	≤ 1.5 dB
	18-22	≤ 1.5 dB
3	17	≤ 1.5 dB
	18-22	≤ 1.5 dB

Table III G Diplexer Transmission Insertion Loss Requirements

6. RF Isolation

The RF Isolation from Port 1 to Port 2 for the frequencies of channel 17 shall be ≥ 30 dB, while the isolation from Port 1 to Port 3 for the frequencies of channels 18-22 shall be ≥ 30 dB.



P O Box 296
1100 West Hollyvale Street
Azusa CA 91702

G Diplexer Product Specification Fly Sheet

7. Electrical Isolation

The G Diplexer shall provide electrical isolation between itself and the feedhorn attachment at Port 1.

8. Structural Loads

The G Diplexer shall be able to operate following a launch environment. For the purposes of this specification, the G Diplexer shall operate after being exposed to 14 g_{rms} random vibration (TBR).

9. Operating Temperature

The G Diplexer shall meet all of the performance criteria throughout the temperature range of -8°C to $+45^{\circ}\text{C}$.

10. Survival Temperature

The G Diplexer shall be able to survive the temperature range of -30°C to $+45^{\circ}\text{C}$.

G Diplexer Statement of Work

Aerojet shall deliver to the vendor a Purchase Order, this Statement of Work, and the G Diplexer Product Specification with the precedence of the documents being in the aforementioned order.

The Supplier shall design a G Diplexer as prescribed in these documents and deliver to Aerojet the following items:

1. Detailed Development Plan

The Detailed Development Plan shall be complete with task durations, applied resources, and sufficient milestones to implement an earned value reporting system.

2. Monthly Earned Value Reports

The Monthly Earned Value Reports shall commence one month after the delivery of the Detailed Development Plan, and shall be delivered every month for the duration of the contract. These reports shall report both CPI and SPI consistent with ANSI/EIA 748. In the event that either CPI or SPI fall below a level of 0.90, the Monthly Earned Value Report shall contain a plan for correcting the deficit.

3. Preliminary Design Review (PDR)

Upon completion of the preliminary design, the Supplier shall host a Preliminary Design Review (PDR), which will serve as a gate to proceed with continued design, breadboard, and analysis efforts. The PDR shall be held at the Suppliers facility and shall accommodate 3-6 Aerojet personnel. One week prior to the PDR, a preliminary electronic copy of the presentation (Microsoft Powerpoint format) shall be sent to Aerojet. The data contained in the PDR shall be sufficient to demonstrate that with continued design and analysis work, the preliminary design will satisfy all of the requirements specified in AE-TBD. As a minimum the PDR package shall address the following items:

- Preliminary Design Drawings
- Preliminary performance analyses, with analytical modeling to demonstrate that the performance requirements will be satisfied with the current design
- Preliminary structural analysis
- Preliminary thermal analysis
- Preliminary materials analysis
- Preliminary Fabrication, Assembly, and Test flow plan

While preliminary work may be performed prior to the PDR (ordering parts, rough machining), no detailed processing shall occur until the successful completion of the PDR.

4. Breadboard Hardware

To validate the PDR design a diplexer shall be fabricated which satisfies the form, fit, and function requirements of the flight hardware. This hardware shall be delivered to Aerojet with test data demonstrating compliance with the specifications.

5. Draft Test Procedure

A draft copy of the G Diplexer Test Procedure shall be delivered to Aerojet in electronic form (Microsoft Word) for review pertaining to satisfying the requirements.

6. Critical Design Review (CDR)

Upon completion of the final design, the Supplier shall host a Critical Design Review (CDR), which will serve as a gate to proceed with continued fabrication and test of the EDU and PFM hardware. The CDR shall be held at the Suppliers facility and shall accommodate 3-6 Aerojet personnel. One week prior to the CDR, a preliminary electronic copy of the presentation (Microsoft Powerpoint format) shall be sent to Aerojet. The data contained in the CDR shall be sufficient to demonstrate that the current design will satisfy all of the requirements specified in AE-TBD. As a minimum the PDR package shall address the following items:

- Released Design Drawings
- Final performance analyses, with analytical modeling to demonstrate that the performance requirements will be satisfied with the current design
- Final structural analysis
- Final thermal analysis
- Final materials analysis
- Released G Diplexer Test Procedure
- Final Fabrication, Assembly, and Test flow plan

While preliminary work on the EDU hardware may be performed prior to the CDR (ordering parts, rough machining), no detailed processing shall occur until the successful completion of the CDR.

7. Engineering Development Unit (EDU)

Fabricate 2 sets of hardware as defined as a result of the Critical Design Review. The test requirements are those stated in the Diplexer Test Procedure, and the packaging requirements are those stated in AE-TBD. Deliverable items for each of these units shall be:

- Diplexer hardware
- Raw material certifications
- Pre-environmental functional test data
- Environmental test data
- Post-environmental test data

8. Proto-Flight Model (PFM)

Fabricate 1 set of hardware as defined as a result of the Critical Design Review, and with the addition of any Aerojet approved changes which may result from completion of the EDU testing. The test requirements are those stated in the Diplexer Test Procedure, and the packaging requirements are those stated in AE-TBD. Deliverable items for this unit shall be:

- Diplexer hardware
- Raw material certifications
- Pre-environmental functional test data
- Environmental test data
- Post-environmental test data

G Feedhorn

Product Specification Flysheet

Aerojet intends to replace this document with a full product specification, the sole purpose of this document is to demonstrate to the United States State Department the type of parameters which must be conveyed to a foreign entity in order to facilitate the design and development of the G Feedhorn.

1. Product Functional Description

Under a NASA contract, Aerojet will build the Advanced Technology Microwave Sounder (ATMS), a next generation, satellite microwave instrument for use in weather forecasting and climate change research. The instrument will measure microwave energy emitted and scattered by the atmosphere. When combined with observations from an infrared sounder, ATMS will provide daily global atmospheric temperature, moisture, and Aerojet to ODTG pressure profiles. The first ATMS will fly on the National Polar-Orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project mission, a joint effort between NASA and the NPOESS program office. NPOESS is a tri-agency program, including NASA, NOAA and the U.S. Air Force.

The G Feedhorn is a corrugated conical feedhorn that collects the energy for channels 17-22 of the instrument, and transmits this energy to the appropriate receiver component for these channels. This device has 2 ports: Port 1 is the input aperture and receives the RF energy from the scene, Port 2 is the output port, which transmits this RF energy by means of a waveguide to the receiver components.

2. Product Physical Description

The maximum envelope for the G Feedhorn dimensions are shown in Figure 1 (dimensions are in millimeters). The maximum weight for this device shall be ≤ 0.04 Kg.

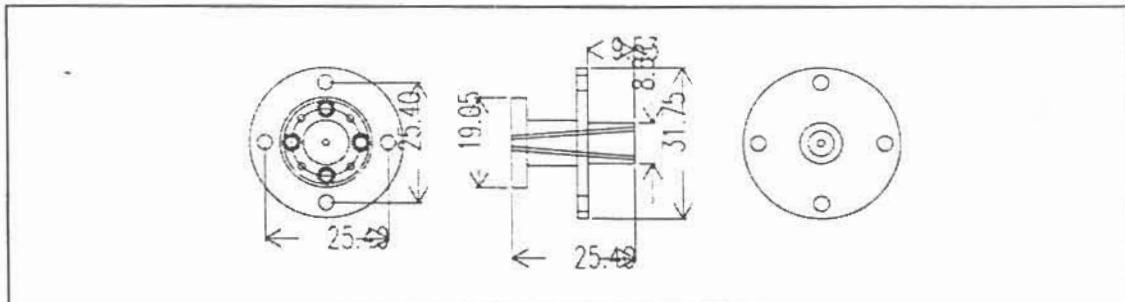


Figure 1 G Feedhorn Envelope Specification

3. Frequency and Bandwidth Designations

For the purpose of the specifications contained within this flysheet, the frequency and bandwidths for the channels shall be as shown in Table I.

Channel	Frequency (Ghz)	Bandwidth (Mhz)
17	166.30	3,000
18	183.31±7.0	2,000
19	183.31±4.5	2,000
20	183.31±3.0	1,000
21	183.31±1.8	1,000
22	183.31±1.0	500

Table I G Feedhorn Frequency and Bandwidth designations.

4. VSWR

The VSWR shall be as shown in Table II.

Port	Channel	VSWR
2	17	≤ 1.2:1
	18-22	≤ 1.2:1
	18-22	≤ 1.2:1

Table II G Feedhorn VSWR Requirements

5. Transmission Insertion Loss

The transmission insertion loss of the G Feedhorn shall be as shown in Figure III.

Port	Channel	Transmission Insertion Loss
1 to 2	17	≤ 0.02 dB
	18-22	≤ 0.02 dB

Table III G Feedhorn Transmission Insertion Loss Requirements

6. Feedhorn Radiation Pattern

The antenna Radiation Patterns of the G Feedhorn shall be as stated in Table IV. For this purpose the design shall meet specification at the channel 17 frequency, and the LOW, MID, and HIGH frequencies of the channels 18-22 frequencies.

Channel	Frequency	Beamwidths		
		3 dB	10 dB	20 dB
17	166.30 Ghz	$11.8^{\circ} \pm 5\%$	$21.0^{\circ} \pm 5\%$	$28.4^{\circ} \pm 5\%$
18-22 _{LOW}	175.33 Ghz	$11.1^{\circ} \pm 5\%$	$19.7^{\circ} \pm 5\%$	$26.7^{\circ} \pm 5\%$
18-22 _{MID}	183.33 Ghz	$10.8^{\circ} \pm 5\%$	$18.5^{\circ} \pm 5\%$	$25.4^{\circ} \pm 5\%$
18-22 _{HIGH}	191.33 Ghz	$10.3^{\circ} \pm 5\%$	$18.0^{\circ} \pm 5\%$	$24.3^{\circ} \pm 5\%$

Table IV G Feedhorn Radiation Pattern Specifications

7. Structural Loads

The G Feedhorn shall be able to operate following a launch environment. For the purposes of this specification, the G Feedhorn shall operate after being exposed to 14 g_{rms} random vibration (TBR).

8. Operating Temperature

The G Feedhorn shall meet all of the performance criteria throughout the temperature range of -8° C to +453 C.

9. Survival Temperature

The G Feedhorn shall be able to survive the temperature range of -50° C to +45° C.

G Feedhorn Statement of Work

Aerojet shall deliver to the vendor a Purchase Order, this Statement of Work, and the G Feedhorn Product Specification with the precedence of the documents being in the aforementioned order.

The Supplier shall design a G Feedhorn as prescribed in these documents and deliver to Aerojet the following items:

1. Detailed Development Plan

The Detailed Development Plan shall be complete with task durations, applied resources, and sufficient milestones to implement an earned value reporting system.

2. Monthly Earned Value Reports

The Monthly Earned Value Reports shall commence one month after the delivery of the Detailed Development Plan, and shall be delivered every month for the duration of the contract. These reports shall report both CPI and SPI consistent with ANSI/EIA 748. In the event that either CPI or SPI fall below a level of 0.90, the Monthly Earned Value Report shall contain a plan for correcting the deficit.

3. Preliminary Design Review (PDR)

Upon completion of the preliminary design, the Supplier shall host a Preliminary Design Review (PDR), which will serve as a gate to proceed with continued design, breadboard, and analysis efforts. The PDR shall be held at the Suppliers facility and shall accommodate 3-6 Aerojet personnel. One week prior to the PDR, a preliminary electronic copy of the presentation (Microsoft Powerpoint format) shall be sent to Aerojet. The data contained in the PDR shall be sufficient to demonstrate that with continued design and analysis work, the preliminary design will satisfy all of the requirements specified in AE-TBD. As a minimum the PDR package shall address the following items:

- Preliminary Design Drawings
- Preliminary performance analyses, with analytical modeling to demonstrate that the performance requirements will be satisfied with the current design
- SWE (Spherical Wave Expansion) Coefficient File compatible with Tica Grasp8W of the preliminary design
- Preliminary structural analysis
- Preliminary thermal analysis

- Preliminary materials analysis
 - Preliminary Fabrication, Assembly, and Test flow plan
- While preliminary work may be performed prior to the PDR (ordering parts, rough machining), no detailed processing shall occur until the successful completion of the PDR.

4. Breadboard Hardware

To validate the PDR design a feedhorn shall be fabricated which satisfies the form, fit, and function requirements of the flight hardware. This hardware shall be delivered to Aerojet with test data demonstrating compliance with the specifications.

5. Draft Test Procedure

A draft copy of the G Feedhorn Test Procedure shall be delivered to Aerojet in electronic form (Microsoft Word) for review pertaining to satisfying the requirements.

6. Critical Design Review (CDR)

Upon completion of the final design, the Supplier shall host a Critical Design Review (CDR), which will serve as a gate to proceed with continued fabrication and test of the EDU and PFM hardware. The CDR shall be held at the Suppliers facility and shall accommodate 3-6 Aerojet personnel. One week prior to the CDR, a preliminary electronic copy of the presentation (Microsoft Powerpoint format) shall be sent to Aerojet. The data contained in the CDR shall be sufficient to demonstrate that the current design will satisfy all of the requirements specified in AE-TBD. As a minimum the PDR package shall address the following items:

- Released Design Drawings
- Final performance analyses, with analytical modeling to demonstrate that the performance requirements will be satisfied with the current design
- SWE (Spherical Wave Expansion) Coefficient File compatible with Tiera Grasp8W of the final design
- Final structural analysis
- Final thermal analysis
- Final materials analysis
- Released G Feedhorn Test Procedure
- Final Fabrication, Assembly, and Test flow plan

While preliminary work on the EDU hardware may be performed prior to the CDR (ordering parts, rough machining), no detailed processing shall occur until the successful completion of the CDR.

7. Engineering Development Unit (EDU)

Fabricate 2 sets of hardware as defined as a result of the Critical Design Review. The test requirements are those stated in the Feedhorn Test Procedure, and the packaging requirements are those stated in AE-TBD. Deliverable items for each of these units shall be:

- Feedhorn hardware

- Raw material certifications
- Pre-environmental functional test data
- Environmental test data
- Post-environmental test data

8. Proto-Flight Model (PFM)

Fabricate 1 set of hardware as defined as a result of the Critical Design Review, and with the addition of any Aerojet approved changes which may result from completion of the EDU testing. The test requirements are those stated in the Feedhorn Test Procedure, and the packaging requirements are those stated in AE-TBD. Deliverable items for this unit shall be:

- Feedhorn hardware
- Raw material certifications
- Pre-environmental functional test data
- Environmental test data
- Post-environmental test data